ZVX4 MEGABYTER DISK CONTROLLER

USER MANUAL

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Sorrento Valley Associates, Inc.

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INTRODUCTION

Once again Sorrento Valley Associates expands the power and capabilities of the Apple computer for the serious user! With the new ZVX4 Dual Density floppy disk controller, S.V.A. gives you up to FOUR MEGABYTES of "on-line" storage, available for use without changing disks.

The ZVX4 controller adheres to the IBM 3740 single and double density disk formats allowing data exchange among a wide variety of other computer systems. With the ZVX4, the range of applications for your Apple is greatly expanded.

Compatibility with existing systems and the potential for future extensions were major design goals for the ZVX4. Our disk controller allows you to develop and run programs under APPLE DOS, UCSD PASCAL, and the CP/M operating systems. The ZVX4 maintains the standard disk formats and file structures for these three operating systems in the single density mode. A disk created with the ZVX4 may be used on any computer which supports the same operating system WITHOUT ANY CHANGES OR RESTRICTIONS. There are hundreds of different computers which support UCSD PASCAL and CP/M on eight-inch disks, and the ZVX4 allows your Apple to be conversant with them all.

This manual will provide you with the necessary information to use and maintain the ZVX4 controller card. It describes the operation of the disk controller under three major operating systems: APPLE DOS, UCSD PASCAL and CP/M. APPLE DOS will be described in the greatest detail. The UCSD PASCAL and CP/M operating systems require additional software (available from S.V.A.), and a detailed discussion of these environments can be found in the documentation accompanying those software packages.

The ZVX4 can transfer data between densities automatically. Densities may be mixed in any fashion, and you need not specify the density of the disk you are using. The disk controller also allows concurrent use of mini-floppies. You can easily transfer data between 5-1/4" and 8" disks. In addition, it is possible to create BOOTABLE 8" disks for both the APPLE DOS system and the UCSD PASCAL system.

S.V.A. was the first to offer 8" disk capability for the Apple computer and now we have made the best even better. The user now may give his applications even greater capability and is freed from the restrictions of storage space and excessive disk handling that mini-disks have imposed. You are encouraged to explore the new areas now open to you and to take full advantage of them.

DESCRIPTION OF THE ZVX4 DUAL DENSITY CONTROLLER

The ZVX4 card can control four disk drives --- single or double sided. The ZVX4 disk controller recognizes the industry standard IBM 3740 single and double density format. The formats used are as follows:

SINGLE DENSITY:
- 77 tracks per disk side
- 26 sectors per track
- 128 bytes per sector

DOUBLE DENSITY:
- 77 tracks per disk side
- 26 sectors per track
- 256 bytes per sector
- track zero is in single density format

IBM compatible single sided, single or double density disks need not be reformatted when they are received from the factory. If double density is desired, and you have a single density diskette, then the disk must be formatted using the ZVFORMAT utility provided with the distribution software. A disk also can be made into a single density disk by selecting that option when running the ZVFORMAT utility. Formatting a disk has the added benefit of finding some problems with the disk's magnetic surface.

SWITCHING BETWEEN DENSITIES

During normal use of the disk system, you may mix densities freely. You need not specify the density of the disk you wish to access (or even whether it is single or double sided). The controller will automatically 'seek' the proper density. Files may be transferred between disks of different densities and the controller will take care of the details.

APPLEDOS VOLUMES

When using the Apple DOS operating system it should be noted that in the double density mode a single side is split into TWO volumes, V1 and V2. If you are using double sided disks then there will be four volumes per drive (diskette). Care should be taken to always specify the volume desired since DOS will assume the last volume specified in some previous operation. See the section on OPERATION IN THE APPLEDOS ENVIRONMENT for further details.

SOFT-DMA DATA TRANSFER

SVA has developed a proprietary high speed DMA data transfer technique which allows the full disk data transfer speed of 500k bits per second yet does not use or interfere with the Apple's DMA system. This avoids many potential problems such as conflicts with other DMA devices, memory refresh timing, etc. This is achieved through the addition of some "soft" DMA instructions to the Apple computer.

DRIVES

The ZVX4 dual density disk controller can control up to four drives, any of which may be single or double sided. It should be noted that double density operation is not related to the drives themselves; it is a special recording technique that any 8" floppy disk drive will support. Drives that support the industry standard Shugart interface will probably work with the ZVX4.

WRITE PROTECTION

As with mini-disks, 8" floppy disks have a notch or hole which serves to write-protect the disk. When this hole is uncovered, information cannot be written to the diskette. This is a means of protecting valuable data. You will receive a general I/O error if you attempt to access a disk that is write-protected, so take care that you cover the hole on the disk if you wish to write information on it.

DOUBLE SIDED DISKS AND FLIPPY DISKS

The user snould be aware of the distinction between double sided floppy disks and double sided "flippy disks". Both types of disks have information stored on each side, but a double sided disk can have its second side read without it having to be removed. A flippy disk must be removed, flipped over, and re-inserted like a cassette tape, in order to read the data on the second side. Double sided disks can be read only in double sided drives and simply will not work in a single sided drive. Single sided disks and flippy disks can be read in either type drive. Some people have learned how to punch a hole in a single sided disk and create a flippy disk. This is a very dangerous practice and is strongly discouraged. The magnetic material on the other side of a single sided diskette has not been certified, usually because there is something wrong with it.

The following table summarizes the various capabilities and restrictions of the ZVX4 controller when used with the supported operating systems.

	DOS 3.3 DOS 3.2	PASCAL 1.0	PASCAL 1.1	CP/M 2.2
special utilities required	ZVFORMAT WRITEBOOTER SD/DDCONFIG	NONE	NONE	DDZVX4.COM
densities supported	SINGLE DOUBLE	SINGLE	SINGLE DOUBLE	SINGLE DOUBLE
memory required	48 K	64 K	64 K	64 K
boot disks	MINI or 8-INCH (SD & DD)	MINI or 8-INCH (SD ONLY)	MINI or 8-INCH (SD & DD)	MINI DISK ONLY
disk structure SS,SD	ONE VOLUME	494 BLOCKS	494 BLOCKS	ONE VOLUME
SS,DD	TWO VOLUMES	------	988 BLOCKS	------
DS,SD	TWO VOLUMES	------	988 BLOCKS	------
(NOTE 1) DS,DD	FOUR VOLUMES	------	1976 BLOCKS	------
storage SS,SD	1 x 247 Kb	247 Kb	247 Kb	247 Kb
SS,DD	2 x 247 Kb	------	494 Kb	494 Kb
DS,SD	2 x 247 Kb	------	494 Kb	494 Kb
(NOTE 1) DS,DD	4 x 247 Kb	------	988 Kb	988 Kb
mini disk slot	ANY SLOT	IN SLOT 6	IN SLOT 6	IN SLOT 6
S.V.A. part number	--------	SPS-S07-5	SPS-D07-5	SCS-D07-1

NOTE 1. The storage values indicated are "formatted" storage, meaning the actual amount of data you may store on the disk forgetting about the sectoring information also on the disk. "Kb" refers to Kilobytes which are multiples of 1024 bytes, e.g. 247 Kb is really 252,928 bytes (decimal). UCSD Pascal blocks are 512 bytes of storage. The first track on the disk (track 00) is never included in the calculations since it is reserved for bootstrap code whether or not a bootstrap is actually used.

IMPORTANT NOTICE

PLEASE READ THIS BEFORE PROCEEDING

* READ ALL THE DOCUMENTATION BEFORE SETTING UP AND USING YOUR CONTROLLER.

* READ THE WARRANTY AND COPYRIGHT NOTICE AND UNDERSTAND YOUR RESPONSIBILITIES.

* PROMPT RETURN OF YOUR OWNER REGISTRATION FORM WILL ENSURE THAT YOU RECEIVE THE LATEST ANNOUNCEMENTS OF IMPROVEMENTS, NEW PROGRAMS, AND NEW CAPABILITIES OF YOUR ZVX4.

* NEVER PLUG IN OR REMOVE THE CONTROLLER CARD WHILE THE APPLE'S POWER IS TURNED ON.

* ALWAYS HAVE THE DRIVE DOOR OPEN WHEN SWITCHING POWER ON OR OFF. POWER TRANSIENTS COULD CAUSE AN INADVERTANT WRITE OF GARBAGE DATA TO THE SURFACE OF YOUR DISKETTE. S.V.A. CANNOT GUARANTEE THE PERFORMANCE OF YOUR SYSTEM IF YOU DO NOT FOLLOW THIS CONDITION.

* DO NOT ATTEMPT TO 'CONVERT' SINGLE SIDED DISKS TO DOUBLE SIDED DISKS; USE ONLY APPROVED DOUBLE SIDED DISKS WHICH HAVE BEEN TESTED AND APPROVED ON BOTH SIDES.

* IF YOU EXPERIENCE ANY PROBLEMS, PLEASE ENSURE THAT YOU HAVE READ ALL OF THE DOCUMENTATION AND ARE PROCEEDING PROPERLY. REFER TO THE TROUBLESHOOTING SECTION BEFORE TAKING ANY ACTION TO CORRECT YOUR PROBLEM.

* AFTER YOU HAVE SET UP YOUR SYSTEM, BACKUP THE DISTRIBUTION DISKETTE BEFORE PROCEEDING. S.V.A. CHARGES A $25 FEE FOR REPLACING DISTRIBUTION DISKS. ALWAYS HAVE YOUR DISKS BACKED UP BEFORE TRYING OUT ANYTHING FOR THE FIRST TIME. DEVELOP THE GOOD HABIT OF BACKING UP DISKS REGULARLY.

* IT IS IMPORTANT THAT YOU DEVELOP YOUR OWN STANDARDIZED WAY OF MARKING YOUR DISKS TO DENOTE SINGLE/DOUBLE DENSITY, SINGLE/DOUBLE SIDEDNESS, AND THE TYPE OF OPERATING SYSTEM REQUIRED. COLOR CODING WORKS WELL. TODAY THERE ARE SO MANY OPTIONS AVAILABLE THAT IT IS POSSIBLE TO BECOME CONFUSED AND PERFORM AN IMPROPER OPERATION CAUSING YOU THE ACCIDENTAL LOSS OF VALUABLE DATA AND TIME SPENT HAVING TO RECOVER THAT LOSS, IF POSSIBLE.

INSTALLATION OF THE ZVX4 CONTROLLER

Installation of the ZVX4 controller card can be done easily by performing the following basic steps:

1. Configure the floppy drives if required; perform all necessary jumpering as shown in the appendix.
2. Set switches on the ZVX4 card to the appropriate setting.
3. Connect the floppy drive package to the ZVX4 card.
4. Insert the card into slot 7 of your Apple computer.
5. Turn on the power and test the system.

The ZVX4 controller card has been used and tested with Shugart, Qume, and Siemens floppy disk drives. In the appendix you will find a listing of the specific models supported. We recommend that you use one of these drives for the best results. If you use some other brand of drive not supported by S.V.A., it is your responsibility to understand the operation of the unsupported drive and configure it to emulate the operation of the ones that are supported. Since S.V.A. supports the use of industry standard Shugart single and double sided drives, complications and confusion will be minimized.

First, ensure that the power is off to all systems before proceeding. Check the drives you are using for proper jumpering (see the appendix). Make any indicated changes.

Select the proper switch settings on the controller card. There are four dip switches located on the bottom of the card closest to the Apple's motherboard. If your drives can handle a 3ms step rate, then select that option. If you are using PerSci drives with the voice coil head positioner, select the fast seek option. All others will have the fast seek option OFF. The other two switches are not used and are reserved for additional future functions.

ZVX4 DISK CONTROLLER DIP SWITCH SETTINGS

	switch "ON" or "CLOSED"	switch "OFF" or "OPEN"
SW-1 =	reserved	
SW-2 =	reserved	
SW-3 =	3 msec. step rate	10 msec. step rate
SW-4 =	fast seek option ON	fast seek option OFF

Connect the appropriate end of the flat cable to the connector on the ZVX4 controller card. The cable should lead AWAY from the card. Refer to figure 1. Note the end of the connector on the card which has the numbers "1" and "2" marked by it. The wire on the edge of the flat cable closest to these numbers is the wire which connects

to "pin 1" and will be our reference. Follow this edge of the cable or the color of the wire to the connector on the opposite end. Connect this end to the drives or the drive package so that "pin 1" will be closest to the slot cut into the connector which is part of the drive or drive package. If there is no slot cut, then "pin 1" for the drive or drive package may be denoted by a dot or the number "1". If no such markings or "keys" exist, the user must refer to the documentation for that drive or drive package.

If multiple drives are being used, the drives must be connected in parallel or "daisy chain" fashion. This means each drive gets the same exact signal as all the others. Jumpering on each drive will identify its drive number and each will respond only when commands for it appear on the cable, ignoring all other transactions. It is important in this case that the drive on the very end of the cable be configured as "drive 1" and have the terminators installed or connected as the jumpering documentation in the appendix indicates. If the terminators are not installed, data errors may occur.

With the power off, insert the controller card securely into slot 7 of the Apple computer. Fold the cable over the card, make a 90 degree fold and lead the cable alongside the card (the side with no components on it), and out the rear of the computer.

Ensure that the remainder of the system has been set up properly according to the instructions accompanying the computer. After you have double-checked everything, apply power to the entire system simultaneously or if this is impossible, apply power to the Apple first and then to all other peripheral devices. Shutting off the power should be done in the reverse fashion so that the computer is always the first to go on and the last to go off. This is the customary procedure for powering up any electronic system and will avoid possible damage to your equipment.

Upon the application of power, insert the distribution disk in drive 1. If your Apple has the auto start feature, the computer will start its boot attempt as soon as the door is closed. If the computer already was on, you may initiate the bootstrap process by pressing the RESET button on the computer. (On some Apples, this is <ctrl>RESET). To ensure a successful boot operation, it is recommended that you press RESET before inserting your disk. A beep will be heard and the standard Apple DOS prompt will appear on the screen signified by either a "]" or a ">" character. Insert the disk and then type:

PR#7 <return>

Or, if you are in the Apple monitor, signified by the "*" prompt, and you have not yet booted DOS, then type:

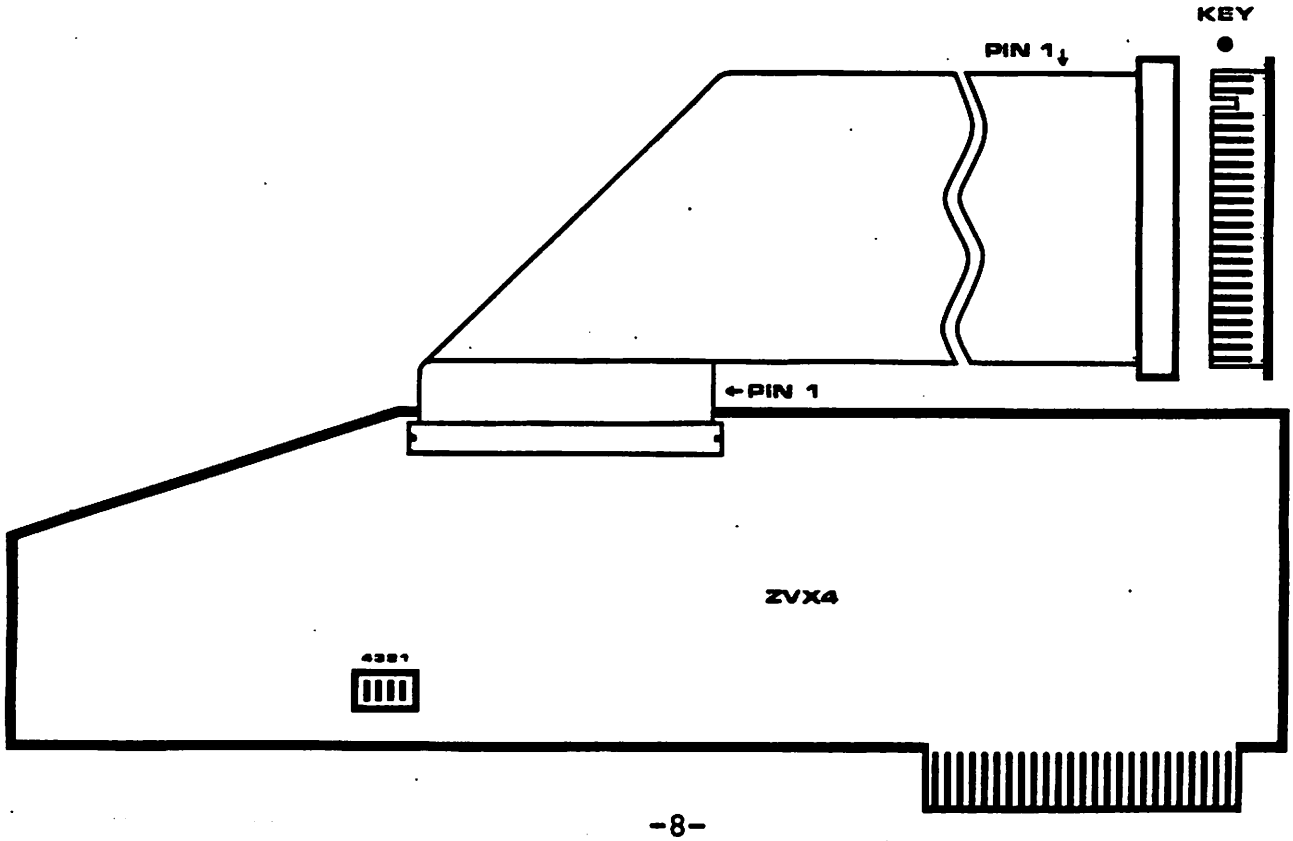
7 <ctrl>K <return>

The disk will start the bootstrap operation and in a few seconds the initial greeting message will be displayed. On Apple computers which have the integer Basic ROMs installed, the computer may print instead, "LANGUAGE NOT AVAILABLE". This means it discovered that the greeting message was written in AppleSoft Basic and it could not run it. This does not affect normal operation. To prove that you have booted successfully, type:

CATALOG

and you will see a display of the distribution software on the disk. The distribution disk is shipped with the write protect function enabled. This means you cannot write to the disk. For your protection we recommend that you never disable this function. The first thing you must do is to create a "working" copy of the distribution disk and put the distribution disk away in a safe place. SVA charges a fee for the replacement of this disk. See the section called OPERATION OF THE ZVX4 IN THE APPLEDOS ENVIRONMENT for instructions on how to create a slave diskette. Then you may use either the FID8 or ZVCOPY utilities to make a duplicate copy of the files on the distribution disk onto a "working" disk which may have the write protect funtion disabled.

You will have to use the distribution disk to run the programs to create your first backup copy. This can be done without having to disable the distribution disk's write protection feature. Write protection, however, does not guard against damage when the disk is outside of the drive such as exposure to magnetic fields, dust, fingerprints, etc. If you experience any difficulty installing your system, refer to the troubleshooting guide in the appendix.



OPERATION OF THE ZVX4 CONTROLLER IN THE APPLEDOS ENVIRONMENT

It is recommended that if the user has not used AppleDos before, the DOS manual should be read thoroughly. Backing up the distribution diskette should be the first thing that the user does before trying anything out. This section will describe how the data is stored on a disk, and how to create a bootable slave diskette.

APPLEDOS VOLUMES

Using DOS with 8" single density disks is the same as using mini-disks except that now there is more than twice as much storage. In double density, however, a single side has been split into two volumes. If the disk is double sided and double density then there are four volumes available equivalent to the storage capacity of 8 mini disks. Putting multiple volumes on a single disk is due to DOS restrictions as to the maximum size of a volume. Care must be taken when referencing multiple volume disks. It will be necessary to always explicitly call out the volume desired when referencing these disks. If the volume is not specified, DOS will use the volume number last used. Unless you are extremely familiar with what you are doing, it it unwise to assume that DOS knows exactly what you want. If you attempt an operation on a volume that does not exist, or is not appropriate, the disk controller has been designed to return an error, thereby aborting the operation. As long as you always call out the volume number, possibility of error is greatly reduced. The following table shows the relationships between disk density, sides, and volumes.

	single sided	double sided
single density	volume 1	volumes 1,2
double density	volumes 1,2	volumes 1,2,3,4

It is best to think of an 8" disk in terms of the number of volumes it carries rather than its density or how many sides it has. Only when creating a slave diskette do you have to be concerned with this issue. During normal operation, the disk controller will handle all the considerations of sidedness and density automatically. Errors will be returned if you attempt an illegal operation. If a volume specified is out of range, a "VOLUME MISMATCH" error message will be displayed.

CREATING A SLAVE DISKETTE

A slave 8" diskette can be created by performing the appropriate steps as follows:

1. Format the disk (may not be necessary)
2. INIT the disk
3. Write the bootstrap (if it is to be a bootable diskette)

FORMATTING DISKETTES

An 8" floppy disk need not be formatted if you purchased it from the factory with the density and sidedness you desire. If you wish to change the density of the diskette, then you must use the ZVFORMAT utility provided on the distribution disk. See USING THE ZVFORMAT UTILITY for complete instructions on formatting a disk.

INITIALIZING DISKETTES

The INIT process is sensitive to the disk from which the bootstrap was made. If you wish to INIT a mini-disk, you must boot from a mini disk. If you wish to INIT an 8" you must boot from an 8" disk. There are no exceptions. The booting process sets up various parameters that are used in the INIT operation; if this rule is not strictly adhered to the INIT will not be successful.

In the case that you booted from a mini-disk and you wish to INIT an 8" disk, an additional utility program, called "CONFIG" has been provided to facilitate this. It patches DOS so that it appears as though you booted from an 8" disk. This utility must be run prior to every INIT command. The syntax for the INIT command is given in the Apple DOS manual. See USING THE CONFIG UTILITY in this document for instructions on how to use it.

A "CONNECT" utility is also supplied which will allow the use of the 8" disk drives if the system was booted from mini-disks. This technique can be used if you are restricted to using the mini-floppies or until such time that a bootable 8" disk can be made. The section describing this utility gives details of operation.

BOOTABLE DISKETTES

Bootable single or double sided single or double density slave diskettes can be created which are compatible with DOS 3.1, 3.2, and 3.3. The initialization of a single or double density disk is different in the case of 8" disks. With mini-disks, an INIT operation will format the disk, write the operating system to it and the bootstrap. With the 8" disks, these are separate operations. To create a slave diskette the user must format the disk (if necessary),

INIT the volume(s), and then write the booter. The boot information is written when the WRITEBOOTER utility is executed. This is a self-prompting utility and easy to operate. See USING THE WRITEBOOTER UTILITY for further instructions.

To boot from the 8" disk drives, a bootable single or double density diskette must be ready in drive 1, such as the distribution disk, and the following command sequence given:

```
press  RESET    <a beep should be heard>
type   PR#7 <return>
```

Disk activity should be heard and finally a "hello" message will be printed on the screen. The user should note that if the "hello" program was written in the kind of BASIC that your Apple does not have, the system may print "LANGUAGE NOT AVAILABLE" instead. In this case, the boot was still successful. To verify you have been successful, type:

```
CATALOG
```

and a display of the directory of files should appear. If this does not occur, repeat this process once again and then refer to the troubleshooting section if you still have a problem. The Apple DOS manual gives instructions on the proper way to boot with your Apple.

OPERATION OF THE ZVX4 DISK CONTROLLER IN THE UCSD ENVIRONMENT

Apple Pascal version 1.0 is currently available for use with the ZVX4 controller in the single density mode only. Version 1.1 will run in both single and double density. To run the UCSD Pascal system it is necessary to have a Pascal Language card available from Apple and the Pascal startup kit available from SVA.

Apple Pascal when used with the ZVX4 controller results in a smooth and easy way to use system. The increased disk space available is completely transparent to the user and no special utilities are required for operation. All documentation for this system is contained in the Apple Pascal manual. Bootable Pascal disks can be made, further simplifying the operation.

8" Pascal is compatible with all previous 8" Pascal systems either on the Apple or other computers. One major advantage of having 8" disk capability is the ability to create a Pascal disk on an Apple and take it to any other type of computer which runs UCSD Pascal (such as Altos, DEC PDP-11,TRS-80) and be able to read the disk without modification. All aspects of the standard directory and disk formats have been maintained. Since most other Pascal systems do not adhere to any particular formatting standard in the double density mode, this compatiblity between systems is limited to single density. The ability to exchange information is at times more important than the ability to cram more information on a single diskette.

OPERATION OF THE ZVX4 DISK CONTROLLER IN THE CP/M ENVIRONMENT

In order to run the CP/M operating system with the ZVX4 controller the following hardware and software items are required:

* Pascal Language card or Microsoft ram which will provide a full 64K of Apple memory
* CP/M system reconfigured to 56K
* CON56 utility provided by SVA
* Z80 card in slot 4
* Mini-disk from which to boot CP/M

SVA has developed software to allow users of CP/M on the Apple computer to add 8" capability to their system. After booting a 56K version of CP/M from a mini-disk, the CON56 program is run. This will allow you to use two of the four drives available to the ZVX4 disk controller as drives "C" and "D" in the CP/M system. 8" disks created on the Apple can be taken and used without modifications on most other CP/M systems, regardless of brand.

It is possible to use double density disks with the CP/M system, but it is impossible to create a bootable 8" disk. SVA has no plans to provide this capability. Additional details of operation are supplied with the utility when purchased from SVA.

ZVX4 SUPPORT SOFTWARE

The following programs will be found on the bootable double density distribution diskette supplied with the ZVX4 controller card:

1. ZVFORMAT: A utility to allow the user to format a single sided or double sided disk in single or double density.
2. CONFIG: Patches Apple DOS to allow an 8" diskette to be INIT-ed if the user booted from a 5-1/4" diskette.
3. WRITEBOOTER: Writes the bootstrap information to allow a bootable 8" disk to be created for the Apple DOS system.
4. ZVCONNECT: Patches Apple DOS to allow the 8" disks to be used when Apple DOS has been booted from mini-disks.
5. ZVCOPY: A volume and disk copy program for mass file transfers or disk backup.
6. FID8: A modified version of FID to handle more than 2 drives.
7. ZVCONVERT: A utility disk which converts a ZVX4 compatible disk to a DISK 2+2 compatible disk and vice versa.
8. DDCOPY: A track by track disk copy program.

The utility programs which are written in BASIC come in two versions. The programs which have a ".I" suffix, e.g. writebooter.I, are the integer basic versions of the programs. No suffix implies that it is the Applesoft basic version, and the ".OBJ" suffix means it is a machine language module used by writebooter program itself regardless of which writebooter program was invoked. DO NOT run files such as writebooter.obj.

Since there are many combinations and possible situations, we recommend that the user perform all functions exactly as described and make no assumptions. Specify all parameters in the command lines and take no shortcuts.

USING THE ZVCONNECT UTILITY

This utility is provided so that the user can "connect" the 8" drives to the system if the system was booted from mini-disks. This program should be moved to the mini-disk being used if the 8" floppies are used and you do not intend to make an 8" bootable copy of that mini-disk. It is necessary that you boot from an 8" disk in order to transfer the file to the mini-disk. In the case that you cannot boot from the 8" drives, the following command sequence will allow you to do a long-winded "connect" so that you will be able to access the 8" drives.

```
] CALL-151
* CFFF
* C700
* 3D0G
] CALL -14309
      (the 8" disk with ZVCONNECT on it should be in drive 1)
] CATALOG S7,D1
      (ZVCONNECT should show up in the directory)
] RUN ZVCONNECT,S7,D1
```

You MUST run ZVCONNECT in order to make the complete set of patches to DOS so that it will address the 8" drives correctly. If you intend to INIT an 8" diskette, then see the section on initializing slave diskettes before proceeding.

USING THE ZVFORMAT UTILITY

The ZVFORMAT utility is used to format a single or double sided floppy diskette when you wish to change its density or you have reason to believe the sectoring information may be damaged. It is a self-prompting utility and easy to operate. To format a disk, run the ZVFORMAT utility and specify the drive, the side, and the density desired. When formatting is complete, mark you disks clearly as to their density and sidedness to avoid confusion. It may be best to format all your disks ahead of time so that when a disk is needed you will not be unnecessarily diverted.

ERRORS

When the ZVX4 disk controller writes new sector information, it reads it back to ensure success. If the sector was not written properly, an error message will be generated. If there is an error, the ZVFORMAT utility will print an error message consisting of the track and sector in question and a series of ones and zeros. If you get this information, always write it down. The following example shows how the ones and zeroes are interpreted:

```
00011000
|  |||
|  ||\_____ hardware error
|  |\______ CRC error (error checking code) indicating data error
|  \_______ sector not found
\__________ drive not ready (door open or write protect on)
```

Four of the status indicators are not relevant. When error messages appear, write down the information and try again. Should you have to call for help, this information will be valuable. The inability to format specific sectors on the disk indicates a problem with the disk surface. If it is clear that the disk has a bad area on it, the only alternative is to discard the disk. The only time that you should suspect a problem with the disk controller is if formatting failures occur at random places on the disk and you have tried a number of different diskettes with the same result.

8" FLOPPY DISK DATA STORAGE

All floppy disks have information recorded on them before you use them for the first time. Basic sections of storage on the diskette, called sectors, are pre-written at the factory. There are 77 concentric tracks on a side of a diskette, each track having 26 sectors in it. Each sector is made up of three parts; an ID section which identifies the number of the sector, the data storage area which stores 128 bytes in single density and 256 bytes in double density, and a data check section (CRC) which holds a code that helps the floppy controller tell whether the data stored in the data area is good or in error.

Read and write operations to the floppy disk are handled by the ZVX4 controller and its related software. When you perform an access to the disk system, the system decides which side, track, and sector it needs to find and moves the read/write head to the proper track on tne proper side. It then begins to read the sector numbers of each sector passing underneath the head. When the correct sector comes by, it reads or writes the data into the sector's data storage area and generates new checking information which is stored in the check code area. Please read the description of the ZVX4 controller for additional information on the disk format used.

USING THE WRITEBOOTER UTILITY

This utility simply writes a DOS bootstrap to the first track on a 8" floppy disk that you wish to make bootable. Simply execute the program and you will be asked to which drive you wish to write the booter. If the writing of the bootstrap was successful, a message will be displayed saying so. It does not matter if the disk to which the boot is written is single or double density or single or double sided. If the WRITEBOOTER utility fails, it may be because the write protect hole is not covered, the disk has bad format information, or the disk drive door is opened, etc.

USING THE CONFIG UTILITY

The CONFIG utility is used when the user wishes to INIT an 8" disk and the system was booted from a mini-disk. When the utility is run, it patches various parameters DOS uses to properly initialize a disk. If DOS has the wrong information then the disk will be improperly initialized. It is extremely important that you execute this utility prior to the INIT command and that no other operations take place between CONFIG and INIT.

For added convenience, it is suggested that you always run the CONFIG program before INIT-ing a disk if you boot from mini-disks often. This avoids any confusion. You should follow EXACTLY the procedure shown below. The user should also have prepared a "hello" program which will print a greeting message when the disk is booted.

```
] NEW
] LOAD HELLO
] BRUN CONFIG
] INIT HELLO,S7,D2,V1
    (you should specify the correct slot, drive, and volume numbers)
] CATALOG
    (a display of the catalog on the new disk should be displayed)
```

If the operation was unsuccessful, try it again from the beginning and perform all the steps shown above. If you continue to have difficulty, consult the troubleshooting guide provided in the appendix.

USING THE ZVCONVERT UTILITY

The ZVCONVERT utility allows compatibility between disks created on the ZVX4 disk controller and disks made with SVA's DISK 2+2 single density controller. Basically, this utility shifts data up or down one track depending on the conversion. Simply run the program and you will be asked which conversion you want and which drive the disk to be converted is in.

Because there is no way for the controller or the utility to know what kind of disk you are converting, you must be very careful. It is best to have a backup of the disk you are converting. If for some reason you selected the wrong conversion, DATA WILL BE LOST. This occurs when you accidentally convert a disk to the same type. Read the prompts carefully and you will have no problems. Disks which were made on the DISK 2+2 controller will not be readable by your ZVX4 and this may be a helpful indicator.

COPYING FILES USING THE ZVX4 CONTROLLER

There are two types of copying that the user will be performing; file by file copying and full volume or disk backup. When making a backup copy, the entire disk or volume is transferred to another disk for safekeeping. Should any accidents occur with the information on the "working" disk, the information can be restored from the backup disk. It is highly recommended that you get into a strict habit of backing up your files. Three copy facilities are provided which will help you take care of any copying situation.

USING SVAFID

The FID file transfer utility, as described in the Apple DOS literature, provides the user with various file copying facilities. SVAFID, found on the distribution software disk, is a patched version of FID allowing up to four drives and four volumes to be referenced for a given slot number. A valid volume specification for ZVX4 is in the range 0-4, with volume 0 equivalent to volume 1. The maximum valid volume number with ZVX4 will depend on the sidedness and density of the 8" disk(s) being used. The volume specification for a mini drive should always be 0.

The only operation that cannot be performed with SVAFID is a file transfer from a volume on one diskette to a different volume on another diskette using a single drive. SVAFID will not prompt for disk swapping under those circumstances.

SVAFID is particularlu useful for transferring programs and data on 5 1/4" disks to 8" disks. It is the only copy utility on the ZVX4 distribution disk with such capability.

USING ZVCOPY

ZVCOPY is a multi-purpose disk copy utility which picks up where FID leaves off. It is a self-prompting utility and it is simple to operate. It will allow the backup of an entire volume to any other volume whether on the same or different drive, or allow you to backup an entire disk excluding the bootstrap. See USING THE ZVCOPY UTILITY for complete details of operation.

BACKING UP DISKS

Backing up disks is an important activity and you should get into the habit. With an 8" floppy disk system, much greater amounts of data are at risk. The loss of a double sided double density 8" disk is equivalent to the loss of 8 mini-disks. Purchasing additional disks for backup purposes is a small price to pay with respect to the work that may be required to redevelop a program you had worked on for a whole month and then was lost accidentally.

USING THE DDCOPY UTILITY

DDCOPY performs a disk copy on a track by track basis, with the user capable of specifying the starting and ending tracks. The default starting track is 0, the ending track 76 (ie, the entire disk). Other starting and ending values may be used if desired. DDCOPY will copy either single or double density disks, as long as the destination disk contains the same format as the source disk. All data is verified after having been written to the destination disk. If a copy error occurs the copy operation will terminate with an error message. DDCOPY will copy any type of ZVX4 disk (APPLE DOS, PASCAL, or CP/M) or any other disk using the IBM 3740 or System 34 format.

USING THE ZVCOPY UTILITY

ZVCOPY allows you to copy disk volumes between disks of any size or density. You may copy an entire multiple volume disk in one operation. It is also possible to change the order of the volumes between the source and destination disks.

It is possible to copy a mini-disk to an 8" disk. However, it is not possible to copy an 8" disk onto a mini-disk because in this case, the source disk is twice as big as the destination disk and it won't fit. It is recommended that you use the FID8 utility which will allow a file by file transfer to a mini-disk.

OPTIONS

The various options are obtained by the way in which the user answers the prompts as described below. ZVCOPY provides the following copying facilities:

1. Single volume copy
2. Multiple volume copy
3. Multiple volume copy with mixed source and destination volumes
4. All of a disk copied to the destination excluding bootstrap.
5. Repeat option for multiple copies of the same source disk

SPECIFYING SOURCE AND DESTINATION INFORMATION

Upon entering the ZVCOPY program, two prompts will appear:

```
S(ET SLOT, DRIVE & VOLUME
C(OPY
```

You must first set the slot, drive, and volume information which can be done by pressing "S". After this information has been set and the first copy has been successfully completed as specified, pressing "C" from then on allows you to make the same copy, as specified, without having to reenter the slot, drive, and volume information.

COPYING INDIVIDUAL VOLUMES

Pressing "S" will cause ZVCOPY to prompt you for the source and destination slot, drive, and volume number(s). Extensive error checking has been employed to help catch as many errors as possible. This includes such things as the fact that slots 1 through 6 can have only one volume, or that you cannot copy a volume from slot 7 to a volume in slots 1 through 6 because an 8" volume is twice the size of a mini-disk volume. If you specify slot 7, you will be able to enter up to four volume numbers after the "VOLUME(S):" prompt. The volumes specified in the destination prompt may be in a different

order than those in the source specification allowing you to cross-copy volumes. When the copying of volumes starts, the ZVCOPY program will attempt to copy each volume individually, as specified. Should it find that a volume does not exist, the copying action will cease, and you will be informed as to which volumes were successfully or unsuccessfully copied.

COPYING ALL OF A DISK

Making an exact "image" of a disk, that is, a backup disk, can be done by copying all the volumes from the source to the destination, and then using the WRITEBOOTER utility to make it bootable, if desired.

OTHER CONSIDERATIONS

The ZVCOPY program copies entire tracks rather than individual files. This means that the destination volume need not have been initialized using the INIT command, provided that the source volume HAS been properly initialized. Each track which has data on it is written to the destination disk, read back, and verified to ensure a proper copy. Tracks which have no data are not verified which results in an "uneven" switching between drives. This is normal operation.

EXAMPLE

Here is a sample 'screen' illustrating the volume re-ordering feature of ZVCOPY:

```
SOURCE DISK:

                SLOT: 7

                DRIVE: 1

                VOLUME(S): 1  2  1  2
                           !  !  !  !
DESTINATION DISK:          !  !  !  !
                           !  !  !  !
                SLOT: 7    !  !  !  !
                           !  !  !  !
                DRIVE: 2   V  V  V  V

                VOLUME(S): 1  2  4  3
```

In this example, the source disk has 2 volumes; it may be either a double sided, single or double density disk or a single sided, double density disk. The destination disk is a double sided, double density disk. In this copy operation, volume 1 of the source is being copied to volumes 1 and 4 of the destination. Volume 2 of the source is being copied to volumes 2 and 3 of the destination. Chances are you will not make an arbitrary copy such as this, but this example serves to illustrate the versatility of ZVCOPY for multiple volume copies.

GENERAL NOTES ON DISK DRIVE SETUP

PerSci drives can be used with the ZVX4 disk controller and feature a voice coil head positioner for faster access time. A switch selectable option on the controller card tells the firmware that this kind of drive is being used and to make the appropriate changes in the control of the drive. See the PERSCI interface notes (p 26a) for particulars on using the PERSCI model 277 with ZVX4.

The power supply which powers your drives should be able to power all the drives in your system with all of their stepper motors enabled. If your system can only support one enabled stepper motor at a time (e.g. Micromation drive package), then please contact our service department for special jumpering details. In general, however, assume that your power supply has adequate capability.

If you are attempting to configure drives to work with the ZVX4 that are other than the Shugart, Qume, Seimens, and PerSci, then it is completely up to you to figure it out and SVA will not be able to assist you. We will, however, provide you with some clues. First, obtain information as to how your drives can be setup to emulate the industry standard Shugart drives. In addition, the controller card expects the following conditions from a floppy drive:

1. Head select is obtained from drive select
2. Stepper motor enabled from drive select (or always enabled)
3. Headload is independent of drive select status
4. Door lock and light enabled from headload

SVA is not responsible for any damage to the ZVX4 controller card resulting from improper connection to other electronic equipment.

```
================================================================================
  DISK DRIVE JUMPERING:  SHUGART 800       ( SINGLE SIDED )
================================================================================
SET SW3 ON ZVX4 TO "OFF" (SELECT 10ms STEP RATE)

 LL DRIVES:JUMPER CONNECT: 800,T2,Y,A,B,C,
           JUMPER NOT CONNECTED: DC,801,DS,Z,X,HL

DRIVE 1 ONLY: JUMPER CONNECT: T1,T3,T4,T5,T6,DS1
              JUMPER NOT CONNECTED: DS2,DS3,DS4

DRIVE 2 ONLY: JUMPER CONNECT: DS2
              JUMPER NOT CONNECTED: T1,T3,T4,T5,T6,DS1,DS3,DS4

DRIVE 3 ONLY: JUMPER CONNECT: DS3
              JUMPER NOT CONNECTED: T1,T3,T4,T5,T6,DS1,DS2,DS4

DRIVE 4 ONLY: JUMPER CONNECT: DS4
              JUMPER NOT CONNECTED: T1,T3,T4,T5,T6,DS1,DS2,DS3

================================================================================
  DISK DRIVE JUMPERING:  SHUGART 850       ( DOUBLE SIDED )
================================================================================
SET SW3 ON ZVX4 TO "ON"  (SELECT 3ms STEP RATE)

ALL DRIVES :JUMPER CONNECT: M,RS,NF,IT,Y,C,FS,S2,IW,850,2S
            SHUNT CONNECT:  A,B,I,R,S

            JUMPER NOT CONNECTED:RM,AF,DS,HLL,DL,D,TS,S3,S1,851,DC,
            SHUNT NOT CONNECTED: Z,X,HL

DRIVE 1 ONLY: CONNECT: DS1
              NOT CONNECTED: 1B,DS2,2B,DS3,3B,DS4,4B
              INSTALL: ONE TERMINATOR PACK AT IC3H (near the S1,S2,S3 jumpers)

DRIVE 2 ONLY: CONNECT: DS2
              NOT CONNECTED: DS1,1B,2B,DS3,3B,DS4,4B
              REMOVE: ONE TERMINATOR PACK AT IC3H (near the S1,S2,S3 jumpers)

DRIVE 3 ONLY: CONNECT: DS3
              NOT CONNECTED: DS1,1B,DS2,2B,3B,DS4,4B
              REMOVE: ONE TERMINATOR PACK AT IC3H (near the S1,S2,S3 jumpers)

DRIVE 4 ONLY: CONNECT: DS4
              NOT CONNECTED: DS1,1B,DS2,2B,DS3,3B,4B
              REMOVE: ONE TERMINATOR PACK AT IC3H (near the S1,S2,S3 jumpers)


NOTES
--------------
  1. The connections on the shunt (IC 4H) which are to be opened, X,Z, and
     HL are done by removing the shunt and bending out the pins on one side
     so that when the shunt is reinserted, continuity is not made.
```

```
================================================================================
  DISK DRIVE JUMPERING:  QUME DATATRACK 8     ( DOUBLE SIDED ONLY )
================================================================================
SET SW3 ON ZVX4 TO "ON"  (SELECT 3ms STEP RATE)

 LL DRIVES: CONNECT:         D,C,Y,DL,DS,A,B,R,I
            NOT CONNECTED: 2S,GND,HA,T40,X,Z,HL

DRIVE 1 ONLY: CONNECT:         DS1
              NOT CONNECTED: B1,DS2,B2,DS3,B3,DS4,B4
              INSTALL:       (2) TERMINATOR PACKS TM1, TM2

DRIVE 2 ONLY: CONNECT:         DS2
              NOT CONNECTED: DS1,B1,B2,DS3,B3,DS4,B4
              REMOVE:        (2) TERMINATOR PACKS TM1, TM2

DRIVE 3 ONLY: CONNECT:         DS3
              NOT CONNECTED: DS1,B1,DS2,B2,B3,DS4,B4
              REMOVE:        (2) TERMINATOR PACKS TM1, TM2

DRIVE 4 ONLY: CONNECT:         DS4
              NOT CONNECTED: DS1,B1,DS2,B2,DS3,B3,B4
              REMOVE:        (2) TERMINATOR PACKS TM1, TM2

NOTES
--------------
  1. The connections on the shunt (U1E) which are to be connected are made
     by putting the appropriate switch to the "ON" position. Connections
     which are not to be made are done by putting the switch to the "OFF"
     or "OPEN" position.

================================================================================
  DISK DRIVE JUMPERING:  SIEMENS FDD 100-8       (SINGLE SIDED)
================================================================================
SET SW3 ON ZVX4 TO "OFF"  (SELECT 10ms STEP RATE)

ALL DRIVES: JUMPER CONNECT: 36,34,24,22,20,18,12,R1,H,L,D,RR,E,SE,2
            JUMPER NOT CONNECTED: 16,G,F,J,K,B,M,V,C,TE,1

DRIVE 1 ONLY: INSTALL: RAD SEL: connect "0"
                       ONE TERMINATOR PACK AT IC 7D

DRIVE 2 ONLY: INSTALL: RAD SEL: connect "1"
              REMOVE:  ONE TERMINATOR PACK AT IC 7D

DRIVE 3 ONLY: INSTALL: RAD SEL: connect "2"
              REMOVE:  ONE TERMINATOR PACK AT IC 7D

DRIVE 4 ONLY: INSTALL: RAD SEL: connect "3"
              REMOVE:  ONE TERMINATOR PACK AT IC 7D

NOTES
--------------
  1. DO NOT CHANGE ANY CONNECTIONS IN THE "HARD SECTOR" AREA OR MAKE
     ANY CONNECTIONS IN THE "BINARY SELECT" AREA.
```

Persci Model 277 Interface Specifications

ZVX4 - Persci cable connections:

Persci has a non Shugart compatible interface. Consequently, a special cable must be used with the Persci model 277. All but one of the pin assignments are Shugart compatible; the pin assignment not compatible is indicated by a connecting line between the respective pins.

	ZVX4			Persci 277	
Desc	Gnd	Signal	Signal	Gnd	Desc
Seek complete	9	10	10	9	Seek complete
Headload	17	18------	-16	15	Direct headload
Index	19	20	20	19	Index 0
Ready	21	22	22	21	Ready 0
Select 1	25	26	26	25	Drive select 1 left
Select 2	27	28	28	27	" " 1 right
Direction	33	34	34	33	Direction select
Step	35	36	36	35	Step
Write data	37	38	38	37	Write data
Write gate	39	40	40	39	Write gate
Track 0	41	42	42	41	Track 0
Write protect	43	44	44	43	Write protect 0
Read data	45	46	46	45	Read data

Persci normally loads the head of a disk unit via the drive select line. The jumpering above uses the direct headload line which loads both heads on the model 277 when ZVX4 issues a head load signal. This action can be defeated via a modification to the the PERSCI logic board. The modification is as follows:

1) Remove U59.
2) Lift U3 pin 1 and U3 pin 6
3) Connect U59 pin 1, 2, 6 or 7 (on the board) to U3 pin 1 and U3 pin 6 (the lifted pins)

This modification will cause only the currently selected drive's head to be loaded when ZVX4 issues a headload.

To take advantage of PERSCI's fast seek capability close DIP switch #4 on ZVX4. This enables the fast seek logic.

ZVX4 DISK CONTROLLER DRIVE CONNECTOR PIN ASSIGNMENT

**	all odd pins are connected to ground (0 volts)
26	Drive select 1
28	Drive select 2
30	Drive select 3
32	Drive select 4
14	Side select
46	Read data
38	Write data
40	Write gate
18	Head load
34	Direction select
36	Step
20	Index mark
22	Ready status
42	Track 00 detect
44	Write protect status
10	Seek complete (PerSci only)
2	TG43

ZVX4 DISK CONTROLLER SWITCH SETTINGS

	switch "ON" or "CLOSED"	switch "OFF" or "OPEN"
SW1 =	no side checking (SW1 only used by PASCAL & CP/M software)	side checking
SW2 =	reserved	
SW3 =	3 msec step rate	10 ms step rate
SW4 =	fast seek option ON	fast seek option OFF

NOTE: 1. Fast seek option is for Persci drives only. Set to "OFF" for normal operation.

2. ZVX4 disk controllers are shipped with all switches off unless otherwise noted.

TROUBLESHOOTING GUIDE

If you are having difficulty using your Megabyter 8" disk subsystem, please use the following troubleshooting guide to attempt to identify the problem. Generally, you should attempt any unsuccessful operation at least twice and narrow down the possibilities as much as possible. If the problem has not been cleared, please read the 'BEFORE YOU CALL' section before taking further action.

Q: I can't read a disk I have read successfully before.

A: It is possible that the magnetic material on the disk has been physically or electromagnetically damaged. Disks never should be left sitting around outside their sleeves. Dust can cause problems with the surface of the disk and cause an eventual buildup of gunk on the read/write head. Fingerprints also are devastating. Bending the disk excessively or denting it also will cause problems. Leaving disks sitting next to electronic equipment with motors and transformers in them possibly could erase the disk's data. It is even possible to magnetize the disks so that they cannot be properly formatted again. If you can't read any disks at all then the problem is probably with the disk drive or the electronic circuitry. In this case, also check for loose cables.

Q: I can't access the back side of my double sided disk.

A: Be sure that you are using approved double sided disks in a double sided drive such as the Shugart 850. It is not possible to flip over a double sided disk and read it in a single sided drive like a "flippy disks". You may want to recheck the jumpering on the double sided drives you are using.

Q: The system is on, a bootable disk is in drive one, the door light on, but there is no boot action after typing "PR#7".

A: It is possible that the cable connecting the disk drives to the ZVX4 controller card has been put on backwards. See the section on installation and ensure that pin one on the cable is properly positioned. If you are in the monitor program, booting is started by typing: 7 <ctrl>K <return>. See the Apple manual.

Q: I get the "LANGUAGE NOT AVAILABLE" message.

A: This message occurs when you try to run an integer basic program and your Apple has Appledos basic installed, or vice-versa.

Q: I have a problem formatting a disk.

A: If you get an error message when running the formatter program which indicates the track and sector in error, write this information down and retry the formatting process a couple of times. If the failure always occurs on the same track and sector, then it is very possible that this is a damaged area on the disk and the disk should be replaced. If the error occurs at seemingly random places on the diskette and other diskettes have the same difficulty then a problem with the ZVX4 controller card is suggested.

Q: I often get disk read errors.

A: This can be caused by not properly terminating the cable connecting the disk drives. Drive one is the drive which should have the terminating resistors installed as indicated in the section discussing disk drive setup. This problem may also be caused by dirty read/write heads in your floppy drives. Head cleaning diskettes can be purchased and should be used as part of a regular maintenance routine. Often disks written by other computers have difficulty being read because of head mismatches between the two systems. If a CRC error (the error detection code written in each sector) is indicated, it is possible that the other computer has used a different formula for calculating the check code (CRC).

Q: I get the "I/O ERROR" message.

A: Unfortunately this error message, which is generated by DOS, is so general that it merely indicates that an error has ocurred. It is up to the user to attempt to correlate what is being done with the error message since it relates to a wide variety of problems. Often it is a problem with the disk subsystem, and the user should ask "what is different this time as opposed to the last time I was able to do this successfully."

BEFORE YOU CALL

1. Have on hand as much information as possible concerning the problem. Knowing what "isn't" the problem can also be useful information. Have this information written down. State your problem in general terms first before going into greater detail.

2. Ensure that you have already sent in your registration card or have the date of purchase and the name of your dealer ready.

3. Nothing can be returned to S.V.A. without a RETURN MATERIALS AUTHORIZATION (RMA) number being given by our staff.

4. For fast service, call the S.V.A. service department between the hours of 1:00 and 2:00 PST weekdays.